



## Assessment of the discharges, spills and emissions from offshore oil & gas operations on the Danish Continental Shelf 2018-2022



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### **OSPAR Convention**

The Convention for the Protection of the Marine Environment of the North-East Atlantic (the "OSPAR Convention") was opened for signature at the Ministerial Meeting of the former Oslo and Paris Commissions in Paris on 22 September 1992. The Convention entered into force on 25 March 1998. The Contracting Parties are Belgium, Denmark, the European Union, Finland, France, Germany, Iceland, Ireland, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

### **Convention OSPAR**

La Convention pour la protection du milieu marin de l'Atlantique du Nord-Est, dite Convention OSPAR, a été ouverte à la signature à la réunion ministérielle des anciennes Commissions d'Oslo et de Paris, à Paris le 22 septembre 1992. La Convention est entrée en vigueur le 25 mars 1998. Les Parties contractantes sont l'Allemagne, la Belgique, le Danemark, l'Espagne, la Finlande, la France, l'Irlande, l'Islande, le Luxembourg, la Norvège, les Pays-Bas, le Portugal, le Royaume-Uni de Grande Bretagne et d'Irlande du Nord, la Suède, la Suisse et l'Union européenne.



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## Executive Summary

This report presents the discharge, spill and emission data from offshore oil and gas operations on Danish Continental Shelf (DCS) over the period 2018 - 2022 and the assessment of the data. The annual data is provided in the Appendix 2.

### Level of Activity

The Danish Continental Shelf is a mature oil and gas province within the OSPAR region and production is declining. However, there is still a moderate level of oil and gas production, although this has decreased by almost 51 % in the reporting period from 2018 to 2022, which is partially due to shut down and redevelopment of some installations.

### Discharges & spills

The total quantity of *dispersed<sup>1</sup> oil (aliphatic oil)* discharged to sea from produced water and displacement water fluctuated between a high of 136 tonnes in 2018 and a low of 95 tonnes in 2020 but overall remained fairly stable during the period of 2018–2022 with average of 116 tons/year.

Produced water and displacement water are the main contributors to the oil discharges from the petroleum industry. The total volume of produced water and displacement water discharged saw a decline from approximately 22 million m<sup>3</sup>/year in 2018 to a low of 16 million m<sup>3</sup>/year in 2020.

One installation on the DCS failed in 2018 to meet the performance standard for oil content as an annual average. However, the maximum amount of oil discharged with produced water exceeding the performance standard was 0,034 tonnes in 2018.

The total number of oil spills to the sea less than 1 tonne was high in 2018 (30) but decreased thereafter. The quantity of oil released was generally low but was unusually high in 2018, due to an accidental release of diesel oil from a defect valve on one of the installations.

### Chemicals

The total quantity of chemicals reported *used* offshore varied over the period. In 2019, 27 302 tonnes of chemicals were reported used. Of this, only 0,24 % belonged to the category “substitution chemicals” and 0,02 % to the category List of Chemicals for Priority Action (LCPA). One operator used the latter category in a small amount in 2019.

The total quantity of chemicals *discharged* into the sea over the period 2018 – 2022 varied from approx. 10 967 tonnes in 2019 to a low of 4 419 tonnes in 2020. Of these chemicals only 0,26 % belonged to the substitution chemicals category in 2019. This amount rose to 0,66 % in 2021 mainly due to DK re-classification of sodium hypochlorite. No LCPA substances were discharged during the period.

The number of smaller chemical spills to sea was relatively high although the quantity of chemicals spilled decreased during the period from 2018 to 2022. The number of larger spills remained low but there was a peak in the quantity spilled in 2022 due to a specific incident with leakage of scale inhibitor at one installation.

### Atmospheric Emissions

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<sup>1</sup>. “Aliphatics” and “aromatics” are defined by the reference method set in OSPAR Agreement 1997—16 (Solvent extraction, Infra-Red measurement at 3 wavelenghts). In that context, “aliphatics” and “dispersed oil” mean the same thing.

Atmospheric emissions are not regulated by OSPAR measures, but they are reported annually to OSPAR. For carbon dioxide (CO<sub>2</sub>), a downward trend between 2018 and 2020 was observed followed by a rather stable emission from 2020 to 2022.

The emission of nmVOC<sup>2</sup> and methane (CH<sub>4</sub>) fluctuated between 700 tonnes in 2020 to 1 900 tonnes in 2022 for nmVOC and for methane ranging from 3 400 tonnes in 2018 to 2 000 tonnes in 2022.

Emissions of sulphur dioxide (SO<sub>2</sub>) and nitrogen dioxide (NO<sub>x</sub>) were relatively stable in the period.

## Récapitulatif

Le présent rapport présente les données sur les rejets, les déversements et les émissions pour les opérations pétrolières et gazières offshore sur le plateau continental danois (DCS) durant la période 2018-2022 et l'évaluation des données. Les données annuelles sont présentées dans l'Appendice 2.

### Niveau d'activité

Le plateau continental danois est une région pétrolière parvenue au stade de la maturité, et la production est en déclin. Toutefois, la production de pétrole et de gaz reste modérée, bien qu'elle ait diminué de près de 51 % au cours de la période de notification (2018-2022), ce qui s'explique en partie par la fermeture et le redéveloppement de certaines installations.

### Rejets et déversements

La quantité totale d'hydrocarbures dispersés<sup>3</sup> (hydrocarbures aliphatiques) rejetée en mer dans l'eau de production et l'eau de déplacement a fluctué entre un maximum de 136 tonnes en 2018 et un minimum de 95 tonnes en 2020, mais est restée globalement assez stable au cours de la période 2018-2022 avec une moyenne de 116 tonnes/an.

Ce sont les rejets d'eau de production et d'eau de déplacement qui contribuent le plus aux rejets d'hydrocarbures de l'industrie pétrolière. Le volume total d'eau de production et d'eau de déplacement rejeté a diminué, passant d'environ 22 millions de m<sup>3</sup>/an en 2018 à un minimum de 16 millions de m<sup>3</sup>/an en 2020.

En 2018, une installation du DCS a manqué de satisfaire à la norme de performance relative pour la moyenne annuelle de la teneur en hydrocarbures. Cependant, la quantité maximale d'hydrocarbures rejetée avec l'eau de production dépassant la norme de performance était de 0,034 tonne en 2018.

Le nombre total de déversements d'hydrocarbures en mer de moins d'une tonne a été élevé en 2018 (30) mais a diminué par la suite. La quantité d'hydrocarbures rejetée est généralement faible, mais elle a été exceptionnellement élevée en 2018, en raison d'un rejet accidentel de gazole provenant d'une vanne défectueuse sur l'une des installations.

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<sup>2</sup> nmVOC = Non-methane Volatile Organic Compounds

<sup>3</sup> Les composés « aliphatiques » et « aromatiques » sont définis par la méthode de référence énoncée dans l'Accord OSPAR 1997-16 (Extraction par solvant, mesure par infrarouges à 3 longueurs d'onde). Dans ce contexte, les termes « aliphatiques » et « hydrocarbures dispersés » ont le même sens.

## Produits chimiques

La quantité totale de produits chimiques utilisés offshore a varié durant la période. On a déclaré l'utilisation de 27 302 tonnes de produits chimiques en 2019. Sur cette quantité, seuls 0,24 % appartiennent à la catégorie « produits chimiques de substitution » et 0,02 % appartiennent à la catégorie « produits chimiques devant faire l'objet de mesures prioritaires (LPCA) ». Un opérateur a utilisé cette dernière catégorie dans une faible mesure en 2019.

La quantité totale de substances chimiques rejetée en mer durant la période 2018 – 2022 a varié, passant d'environ 10 967 tonnes en 2019 à 4 419 tonnes en 2020. Sur cette quantité, seuls 0,26 % appartiennent à la catégorie « produits chimiques de substitution » en 2019. Cette proportion est passée à 0,66 % en 2021, principalement en raison de la reclassification de l'hypochlorite de sodium par le Danemark. Aucune substance LPCA n'a été rejetée au cours de la période.

Le nombre de petits déversements de produits chimiques en mer a été relativement élevé, bien que la quantité de produits chimiques déversés ait diminué au cours de la période 2018-2022. Le nombre de déversements plus importants est resté faible, mais il y a eu un pic dans la quantité déversée en 2022 en raison d'un incident spécifique avec une fuite d'inhibiteur de calcaire dans une installation.

## Émissions atmosphériques

Les émissions atmosphériques ne sont pas réglementées par des mesures OSPAR, mais elles sont notifiées une fois par an à OSPAR. En ce qui concerne le dioxyde de carbone (CO<sub>2</sub>), une tendance à la baisse a été observée entre 2018 et 2020, suivie d'une émission plutôt stable entre 2020 et 2022.

L'émission de nmVOC<sup>4</sup> et de méthane (CH<sub>4</sub>) ont fluctué entre 700 tonnes en 2020 et 1 900 tonnes en 2022 pour le nmVOC et entre 3 400 tonnes en 2018 et 2 000 tonnes en 2022 pour le méthane.

Les émissions de dioxyde de soufre (SO<sub>2</sub>) et de dioxyde d'azote (NO<sub>x</sub>) sont restées relativement stables au cours de la période.

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<sup>4</sup> nmVOC = Composés organiques volatils non méthaniques

## 1. Introduction

This report provides an assessment of the discharges, spills and emissions to the North Sea from offshore oil & gas exploration and production installations on the Danish Continental Shelf (DCS) during the period 2018–2022. The purpose of the report is to assess trends related to the effectiveness of the OSPAR measures and the national regulation. Trends have been assessed using expert judgement and not by statistical analyses.

The assessment is based on data submitted by the operators on the DCS to the Danish Environmental Protection Agency (DEPA) and reported by Denmark in the annual OSPAR report on discharges, spills and emissions from offshore oil and gas installations. The assessment is based on the data available at the time, when the annual OSPAR report was submitted (see the Data Annex).

Where relevant, the performance on the DCS has been compared to the overall performance in the OSPAR area, using the following source:

- “Draft OSPAR report on discharges, spills and emissions from offshore oil and gas activity in 2022” (EAP meeting 2024)

This report does not seek to assess the impact on the environment of these discharges, spills and emissions.

It should be noted that Denmark is a medium to small sized oil and gas producer in the OSPAR region. Emissions and discharges on the DCS therefore only contribute to a small degree to the total emissions and discharges in the North Sea area. OSPAR trends in performance are mainly driven by the larger oil and gas producing countries in the North Sea area, making a comparison of performance challenging.

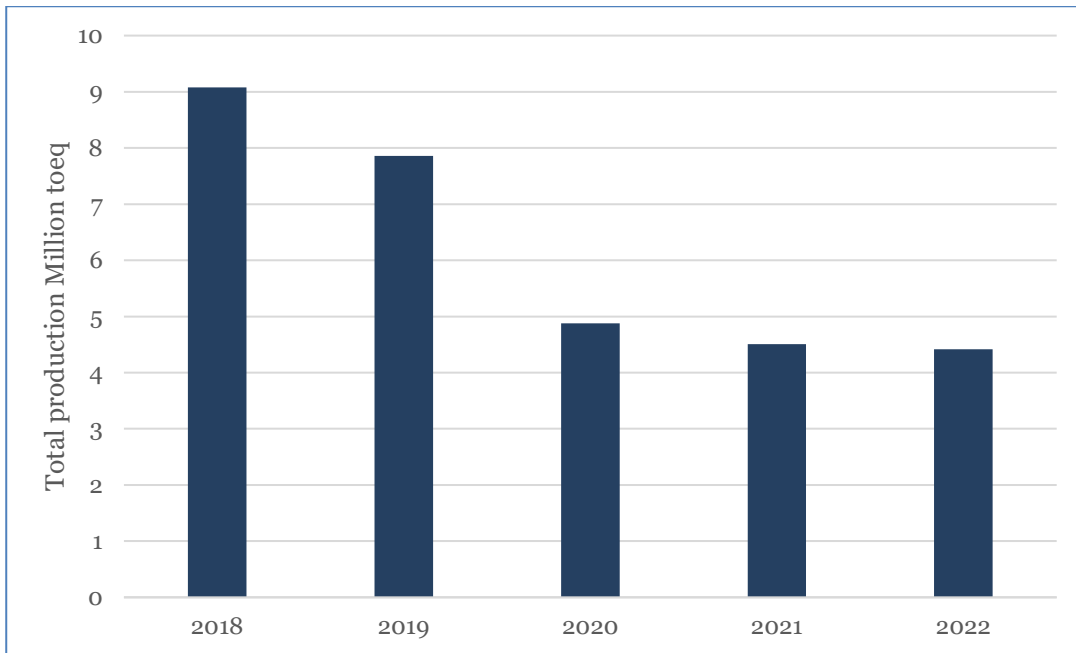
The operators have used procedures for sampling and analysis detailed by the Danish Environment Protection Agency (DEPA), and quality assurance procedures described by DEPA. Certified laboratories have been used.

## 2. Setting the scene

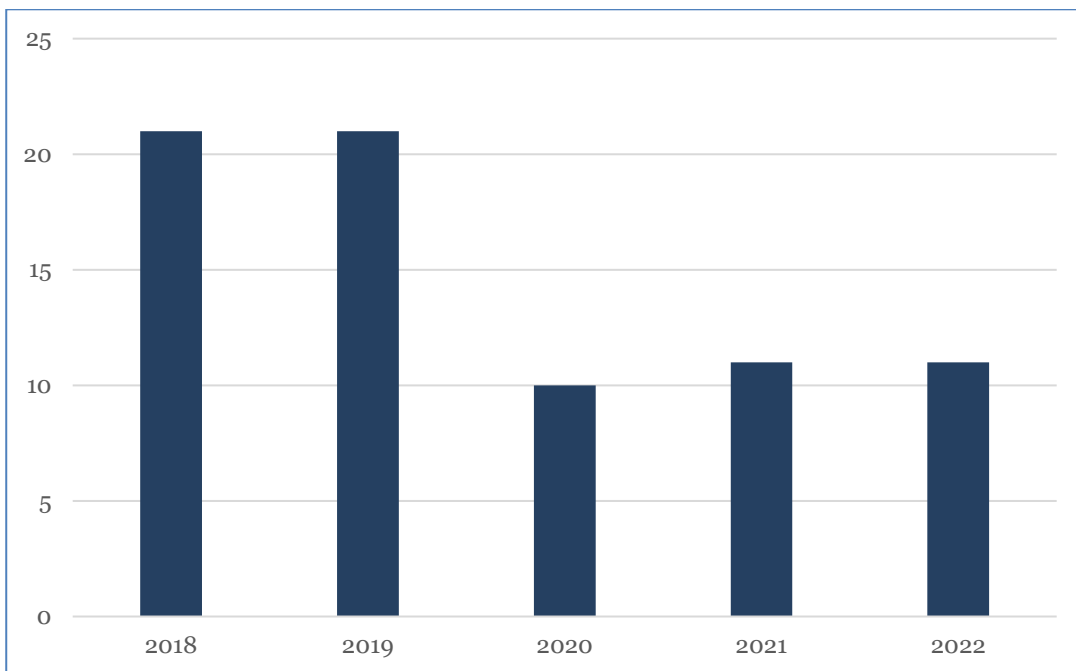
Measured in total oil equivalents (toeq) Denmark was by 2022 the fourth largest producer of oil and gas in the OSPAR region, although its share is only about 1,6 % of the total production. The DCS is a maturing basin, and production on the DCS has been declining since 2004. The decline has continued in the period 2018 – 2022 with a 51 % decrease in production since 2018. However, the decline in the period is related to the reconstruction of the Tyra field. Once the Tyra field is operational again the production is expected to raise to a level comparable to the 2017 level.

Figure 1 shows the official Danish production data in tonnes of oil equivalents.

Figure 2 shows the number of installations with discharges and emissions. It has decreased from 21 to 11. The change is among others due to the temporary shut down and reconstruction of the Tyra field.

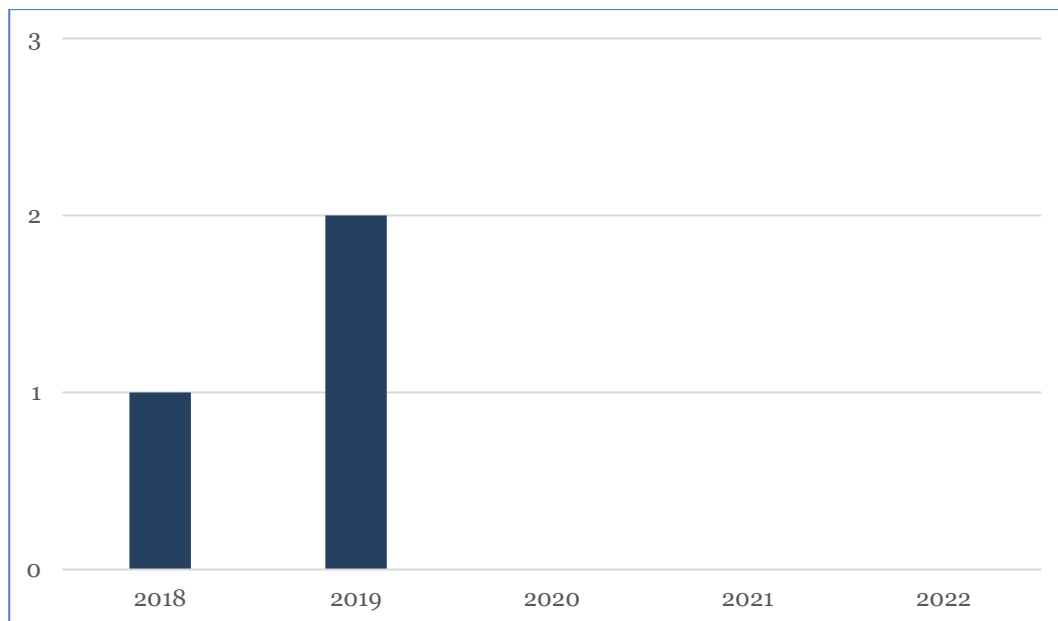


**Figure 1: Annual total production of oil equivalents on the Danish Continental Shelf**



**Figure 2: Number of installations on the Danish Continental Shelf**

Only three wells in total were drilled in 2018 and 2019 together as can be seen in Figure 3. There has been no wells drilled from 2020 to 2022.



**Figure 3: Number of wells drilled on the Danish Continental Shelf 2018 - 2022**

### 3. Environmental Management

In accordance with OSPAR Recommendation 2003/5 to Promote the Use and Implementation of Environmental Management Systems (EMS), the offshore action plan of 2005 agreed between the Danish offshore operators and the Ministry of Environment comprised the goal that all operators by 2006 should establish EMS, that should be ready for certification or other similar scheme.

The EMS should cover both the production and exploration activities of the individual operator. Based on this agreement the two current Danish operators with production activities in the DCS have established EMS in accordance with the ISO 14001 standard and subsequently, these have been certified.

The operators prepare annual environmental reports, that are made available to the public. DEPA does not issue formal approvals related to the operator’s EMS, but DEPA’s inspections both on- and offshore also includes examination of relevant parts of the EMS.

In addition, the discharge permits include requirements for the operators to conduct at least one annual independent verification of the Oil in Water sampling, analysis and reporting procedures. Further, DEPA requires a verification of the procedures related to the measurements of the flow of produced water discharged to the sea or re-injected including procedures for maintenance and calibration of flow meters.

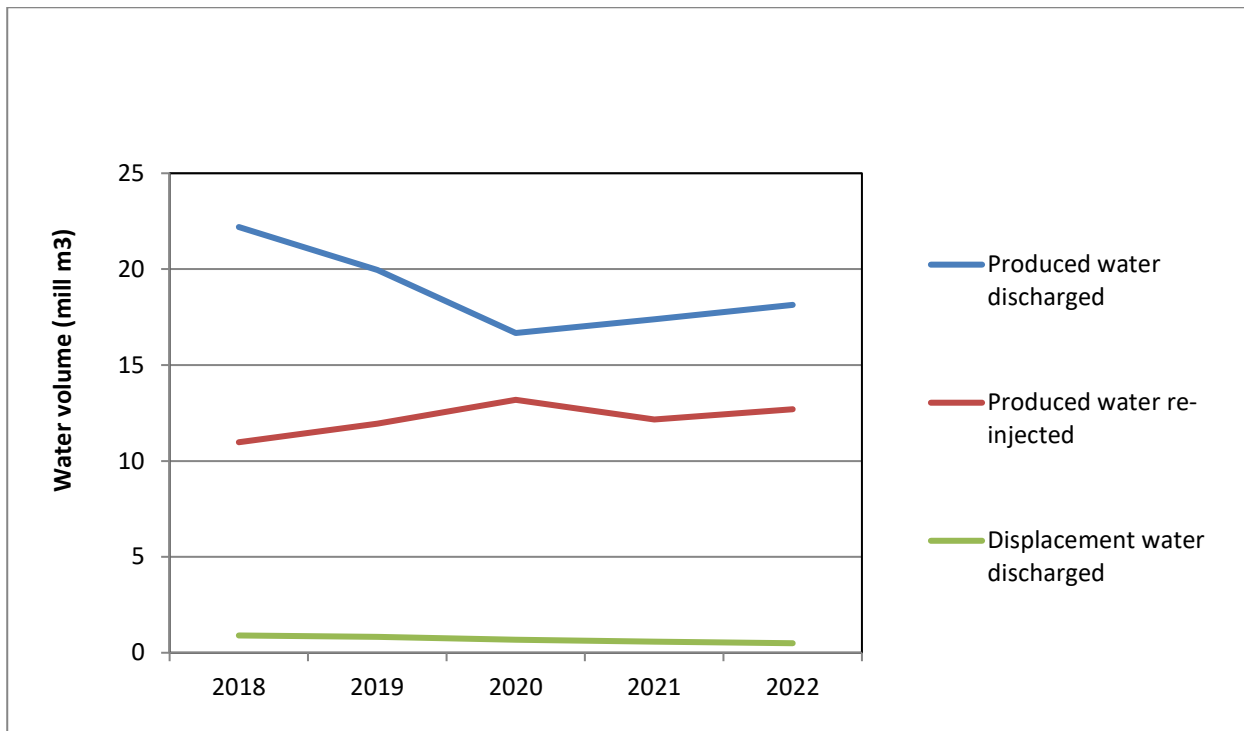
## 4. Oil discharges

### 4.1. Discharges of oil to sea

Discharges of dispersed oil are regulated in accordance with OSPAR Recommendation 2001/1 (as amended). The permits for discharge of produced water include a condition that the oil content as a monthly flow weighed average must not exceed 30 mg dispersed oil per litre of produced water discharged to the sea or re-injected. In Denmark the limit value is waived if the total discharge of dispersed oil over the last 12 months (rolling total) has been below 2 tonnes.

#### Produced water and displacement water

The total volume of produced water generated on the DCS has decreased by 25 % from 2018 – 2020 due to decreasing overall production volumes, however produced water discharges increased by about 9 % from 2020 to 2022 (Figure 4). The decline in volume of produced water discharged from 2018 to 2020 is among others caused by the redevelopment of the Tyra field and a higher re-injection rate performed by other installations.



**Figure 4: Discharges and injection of produced water and displacement water on the DCS 2018—2022**

Comparing this with OSPAR overall figures shows that:

- The discharge of produced water on the DCS have decreased by approximately 18% over the last reporting period from 2018 to 2022. This figure corresponds with the decline in produced water of 19% in the OSPAR area from 2018 to 2022.
- The discharges of displacement water decreased by 45 % on the DCS in the reporting period. The figure for OSPAR fluctuated somewhat in the reporting period with a low in 2019 and a high in 2021, however comparatively stable.

- The produced water re-injected in DCS increased in the reporting period, from 10.976.058 m<sup>3</sup> in 2018 to 12.696.127 m<sup>3</sup> in 2022 an increase of approximately 16%.

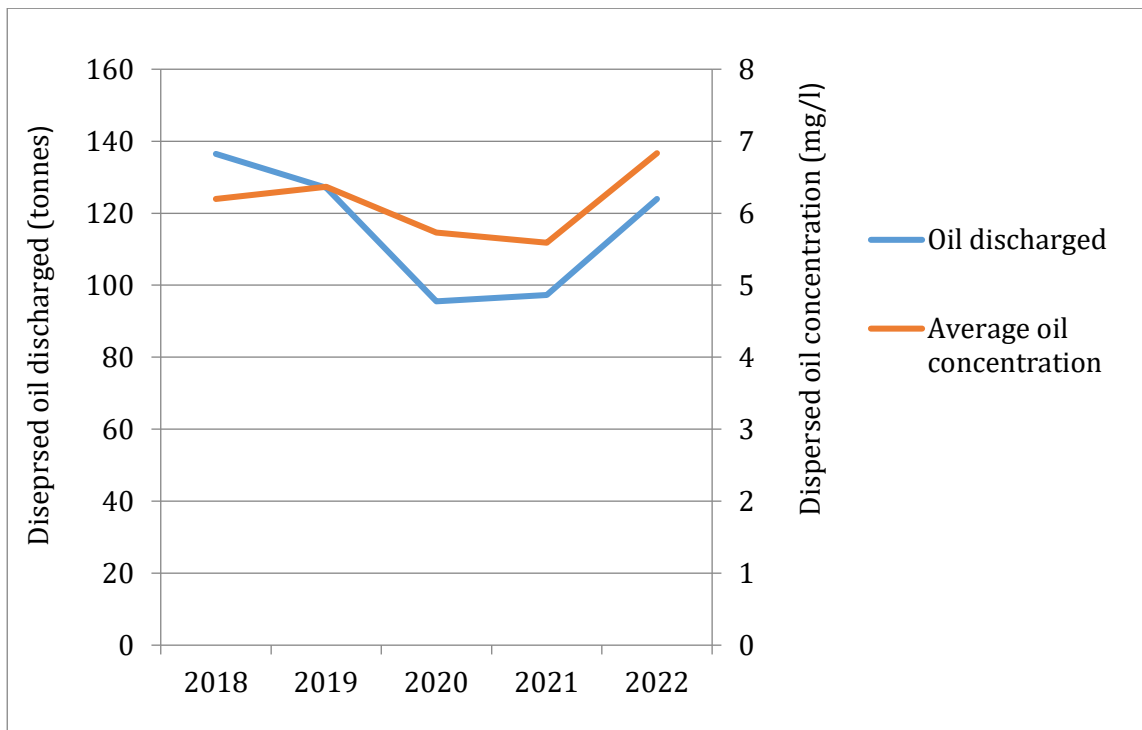
**Dispersed oil discharged**

The total quantity of dispersed oil discharged with produced water and displacement water went from 136 (2018) to 95 tonnes (2020) but increased to 124 tonnes in 2022. The decrease in 2019 to 2021 is caused mainly by the shut down and redevelopment of the Tyra field.

The OSPAR goal of reducing the discharges of dispersed oil with produced water to 85 % of the level in 2000 was reached in 2010. The 85 % level, which on the DCS is equal to 222 tonnes, has since then been set as the national yearly maximum for the total discharge of dispersed oil allowed on the DCS from all the offshore oil and gas activities (named “the national ceiling”). Within this framework the individual discharge permits contains conditions on how much of the 222 tonnes of dispersed oil the individual operators are allowed to discharge to the sea each year.

The dispersed oil discharged with produced water accounted for more than 99 % of the total amount of oil discharged and for some years it was 100%. The average dispersed oil concentration in produced water and displacement water, was in the same period fairly stable around 6 mg/l, but with little higher concentrations in 2022 (Figure 5).

The figures for the dispersed oil concentration in produced and displacement water in the OSPAR area vary slightly, and no temporal trend can be observed over the 2018 – 2022 period. The average concentration in 2022 of oil in produced water on the DCS was significantly lower than the average concentration in the OSPAR area (6,8 mg/l and 14 mg/l, respectively).



**Figure 4: Quantity and concentration of dispersed oil discharges 2018—2022**

Recommendation 2001/1 sets a performance standard for the discharge of dispersed oil in produced water. Since 2007 OSPAR has set the performance standard at 30mg/l. For regulatory purposes in the DCS this is

calculated as a monthly flow weighted average irrespective of the number of samples taken per day. However, for comparison within OSPAR an annual average is used.

In the reporting period from 2018 to 2022, only one installation in 2018 failed to meet the 30 mg/l standard with oil discharged to the sea above the 30 mg/l amounted to 0,034 tonnes.

The quantity of dispersed oil discharged by installations that failed to meet the performance standard has historically been very low in the DCS and was 0 tonnes in 2013, 2016 and 2017. The highest amount recorded for the past 10 years was 0,3 tonnes in 2015 followed by 0,034 ton in 2018.

Denmark also reports the dissolved oil content (as represented by BTEX components) in produced water discharges. OSPAR has not issued recommended discharge levels for these components as they rapidly biodegrade in seawater once discharged. The discharge of dissolved oil<sup>5</sup> (BTEX) in produced water has in the period from 2018 to 2022 shown values ranging from 325 to 74 tonnes tonnes. For the past three years, the BTEX level has remained stable at around 75 tonnes.

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<sup>5</sup> “Aliphatics” (or “dispersed oil”) are regularly and frequently measured, while the sampling is much less frequent for “aromatics”. Therefore data on “aromatics” may be less reliable.

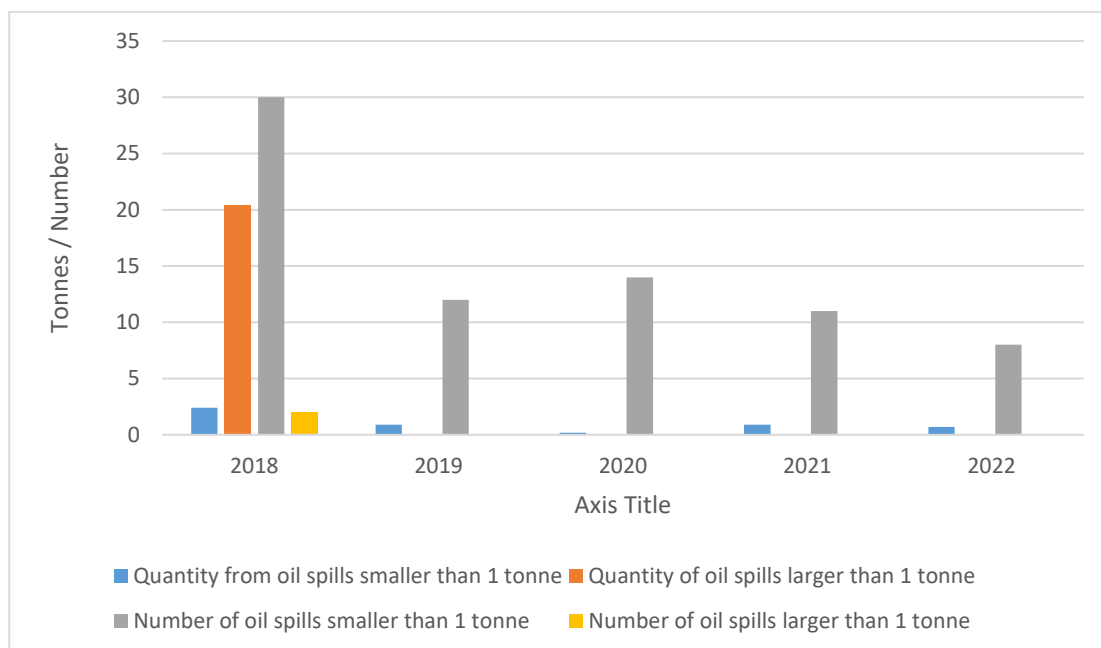
### Risk-based Approach (RBA)

In 2012 OSPAR adopted Recommendation 2012/5 for a risk-based approach to the management of produced water discharges from offshore installations. Denmark has implemented the Recommendation in 2018 and has issued specific requirements in the permits for the installations discharging produced water. DEPA received the most recent RBA reports from the Danish offshore operators in June and September 2022 including calculated field specific Environment Impact Factors (EIFs). A Danish manual for undertaking and reporting the RBA calculations was produced and finalised in September 2018 based on experiences from RBA calculations for all of the discharge points. Requirements for RBA was incorporated into the Danish permits for discharge of produced water in late 2018, effective from 1. January 2019. Presently, two installations out of eleven are meeting the performance level characterized by “Installations where risk is adequately controlled”, i.e. where EIF is below 10. This is mainly due to reinjection of water. Reinjection is not feasible at the other nine installations.

## 4.2. Spills of oil to sea

The total number of oil spills has varied in the DCS between 2018 and 2022, with a high of 32 spills in 2018 and a low of 8 in 2022. The vast majority of the spills were much smaller than 1 tonne and regularly include spills of hydraulic oil.

The quantity of oil released has, as expected, shown larger variations, since it is mainly driven by the small and variable number of spills larger than 1 tonne. In 2018 the main contributor was due to a leak in a diesel tank, which accounted for 20 tonnes of diesel oil spilled to the sea.



**Figure 6: Number of oil spills and total quantity of the spills on the DCS 2018—2022**

Comparing figures from DCS to overall figures from OSPAR indicates the following:

- Between 2018 and 2022 there was generally a decrease in number of oil spills, however with some variation from year-to-year. The same conclusion can be said about the data from the OSPAR area.

- Except from an accidental diesel leak, which occurred at one of the installations in 2018 the quantities of oil spilled from 2018 to 2022 were fairly low. In the OSPAR area the volume of small spills decreased, while the variation in spills larger than 1 tonne showed at large variation.

### 4.3. Discharges of organic phase fluids

Discharge of cuttings contaminated with organic phase fluids (OPF) at a concentration greater than 1% by weight on cuttings is prohibited based on OSPAR Decision 2000/3. Denmark regulates this through conditions in the discharge permits. Although some technologies are able to reduce the concentration of oil to below the 1 % limit, no cuttings contaminated with OPF were discharged on the DCS between 2018 and 2022.

## 5. Chemicals

### 5.1. Chemical Use & Discharge

In this document, the following applies:

The term *substitution chemical* is short for *chemicals which contain one or more substances which are candidates for substitution*, according to OSPAR Recommendation 2010/4. This includes chemicals which are

- on the OSPAR LCPA,
- inorganic with LC<sub>50</sub> or EC<sub>50</sub> less than 1 mg/l,
- have biodegradation less than 20 %, or
- meets two of three criteria:
  - biodegradation less than 60 %,
  - BCF larger than 100 or Log P<sub>ow</sub> ≥ 3, or
  - LC<sub>50</sub>/EC<sub>50</sub> less than 10 mg/L.

Chemicals that are considered to 'Pose Little or No Risk' to the environment are referred to as PLONOR chemicals. Chemicals that are considered to be PLONOR are detailed on the OSPAR PLONOR list.

Chemicals that are neither PLONOR nor candidates for substitution include those that are:

- Inorganic with LC50 or EC50 greater than 1 mg/l,
- Ranking chemicals, which includes substances ranked according to OSPAR Recommendation 2000/4 and which do not fall into another category.

The goal of OSPAR Recommendation 2006/3 is that discharges of substitution chemicals should be phased out by 2017. In addition OSPAR Recommendation 2005/2 set a goal that Contracting Parties should have phased out the discharge of substitution chemicals on the OSPAR 2004 List of Chemicals for Priority Action (LCPA) by 1 January 2010. There are no OSPAR measures against the other categories of chemicals classified within the Harmonised Mandatory Classification System, as these are deemed not to pose a significant risk to the environment.

On the DCS all use, and discharge of offshore chemicals requires a permit. The permit reflects product and function – and amount of chemicals the individual operators have applied to use and discharge per year in the period of the granted permission. The offshore operators on the DCS stopped all discharges of LCPA chemicals by 2004. The plan also stipulates that the discharge of other substitution chemicals should be phased out by the end of 2008. There has been one case in 2019 where an operator has used 5 kg of a substance on the LCPA list with a discharge of 0,45 kg. The quantity of discharged inorganic substances with LC50 or EC50 < 1 mg/l, has increased due the fact, that Denmark re-classified the product sodium hypochlorite in 2017 to be a substitution chemical due to its intrinsic toxic properties.

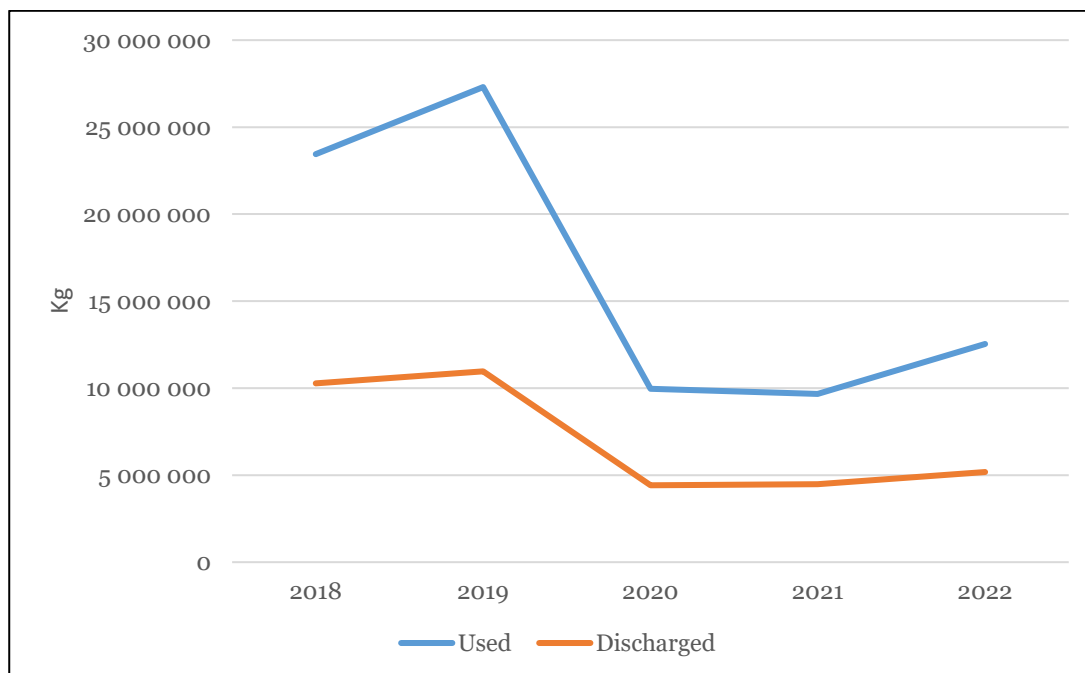
DEPA decided to include a general condition in the permits, that discharge of substitution chemicals is now only acceptable if an evaluation carried out by the operator shows, that the discharge of the substitution chemical - apart from being the best solution technically and in regard to safety - is also from an environmental point of view the best solution. The operator shall also document that alternative offshore chemicals have been evaluated.

The choice, evaluation and ranking of offshore chemicals is the operator's responsibility. DEPA examines the characteristics of the individual offshore chemicals through the pre-screening forms compared with the HONCF forms, which are retrieved through the Danish Product Registry.

### Chemicals Used

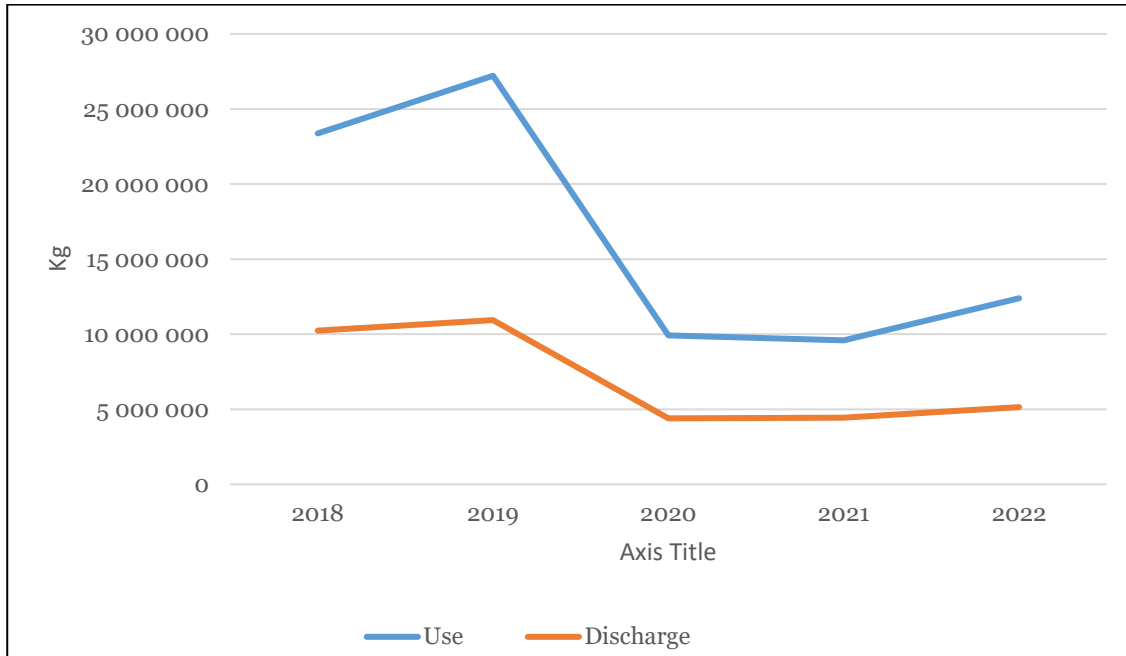
The total amount of offshore chemicals used fell by 47 % between 2018 and 2022, although fluctuations were seen with a maximum of approx. 27 000 tonnes in 2019 and a low of 9 700 tons tonnes in 2021. See figure 8. The increase in use of chemicals in 2019 is mainly due to higher volumes of PLONOR chemicals and inorganic substances LC<sub>50</sub>>1 mg/l, whereas the overall decrease in chemicals is mainly due to the close down and redevelopment of the Tyra field.

Similarly the discharge of chemicals decreased by almost 50% in the reporting period from 2018 to 2022.

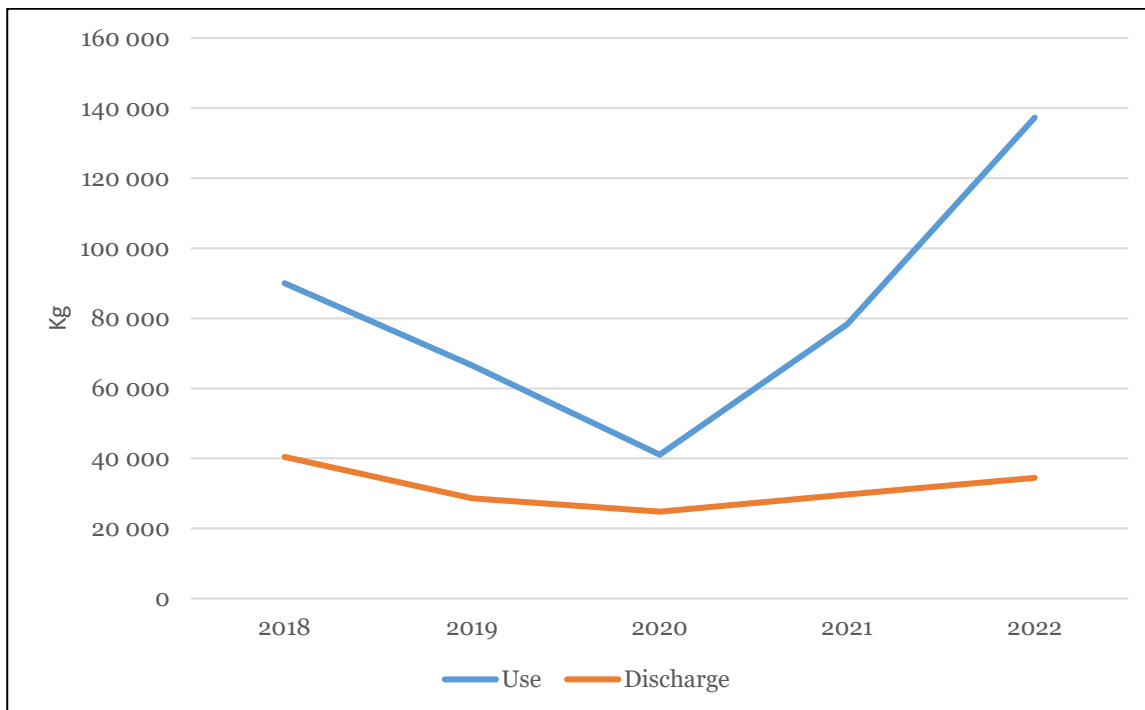


**Figure 7: Total quantity of offshore chemicals used and discharged on the DCS 2018—2022**

The total quantity of chemicals *used* in 2022 on the DCS was approx. 12 500 tonnes. Out of this amount 17,8 % were chemicals on the PLONOR list and approx. 81 % (wt.) were other non-substitution chemicals (Figure 9). In the same year (2022) use of substitution chemicals represented approx. 1 % of the total use on the DCS (Figure 10).



**Figure 8: Quantities of non-substitution chemicals used and discharged 2018—2022**



**Figure 9: Quantities of substitution chemicals used and discharged 2018—2022.**

The peak in the use of substitution chemicals in 2022 is based on an increase in use of well service chemicals at one of the operators. A lesser contribution to the peak in the graph is also due to an increased

application of sodium hypochlorite. Sodium hypochlorite was re-classified in Denmark in 2017 to be a substitution chemical.

According to OSPAR documents, the figures for 2022 demonstrate that almost 69 % of chemicals used were on the PLONOR list, 30 % were other non-substitution chemicals and approx. 1 % was substitution chemicals. Use of LCPCPA chemicals was negligible. Thus,

- the percentage of PLONOR chemicals used in 2022 was considerably lower in DK, approx.18 % compared to the average of approx. 69 % for the OSPAR area.
- the percentage of other non-substitution chemicals used (approx. 81 %) was considerably higher on the DCS compared to the OSPAR area (approx. 30 %), and
- the percentage substitution chemicals used was slightly higher on the DCS (1,1%) than in the entire OSPAR area (0,9 %).

### **Chemicals Discharged**

The total quantity of chemicals *discharged* to the sea on the DCS in 2022 was 5 174 tonnes. Approximately 16 % of these were listed on the PLONOR list, 83 % were other non-substitution chemicals and the remaining approx. and 0,7% were substitution chemicals.

According to OSPAR, the corresponding overall figures for 2022, demonstrates that 82 % of the chemicals discharged were on the PLONOR list, 17% made up for other non-substitution chemicals and less than 1 % of the chemicals were substitution chemicals.

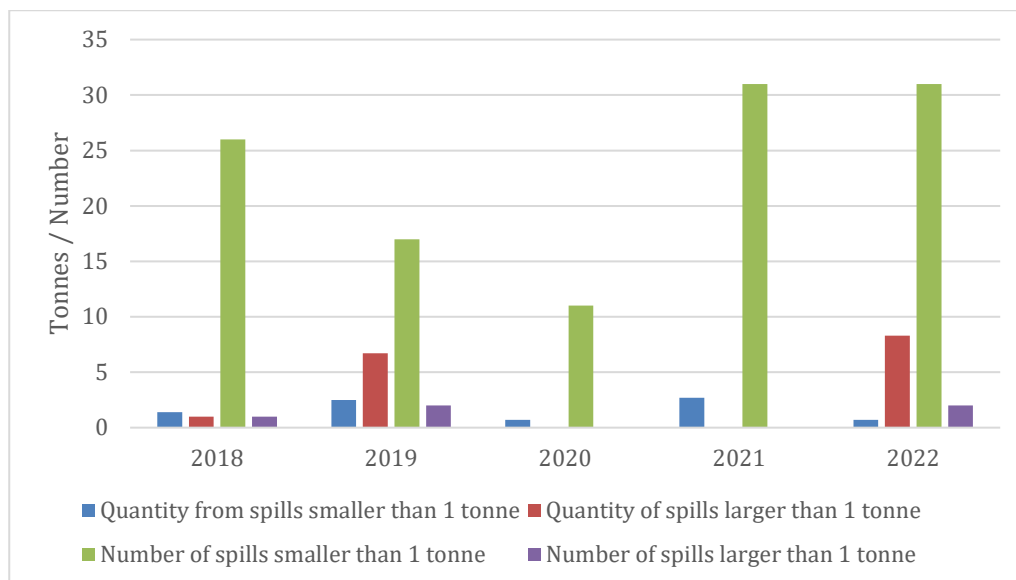
Thus,

- the percentage of PLONOR chemicals discharged on the DCS was lower in 2022 than the average in the OSPAR area in 2022, while
- the percentage of other non-substitution chemicals discharged was higher on the DCS,
- the reported percentage of substitution chemicals discharged on the DCS was comparable to the OSPAR area as a whole.

## **5.2. Chemical Spills**

The number of chemical spills in the reporting period was characterized by both a decrease in number of spills from 2018 to 2020 and then again a rise up to 31 reported spills for 2021 and 2022 for spills < 1 tonne.

The amount of chemicals released through these spills did however, not increase similarly as the average size of the spills remained low in the period. There is no clear trend in the amount of chemicals spilled per year, apart from that the number of spills larger than 1 tonne and quantity of spills smaller than 1 tonne remained fairly low. The high numbers of small spills often comes from spillage of hydraulic oils in small quantities. Hydraulic oil used as hydraulic fluids to control wellheads, blowout preventers and subsea valves is accounted for as a chemical according to “Common Interpretation on which Chemicals are Covered and not Covered by the Harmonised Mandatory Control System under OSPAR Decision 2000/2”.



**Figure 10: Number and quantity of chemical spills on the Danish Continental Shelf 2008—2022**

In the OSPAR area there seems to be no clear trend in both the number of spills and the amount spilled as the data varies from year to year, except that the variation in quantity of the larger spills varies by more than 100% from selected years in the reporting period, whereas the number of spills remain fairly stable. The quantity of large spills on the DCS remain very low comparable to the OSPAR area.

Consequently,

- there is no clear trend for the number of smaller and larger spills on the DCS which is similar to the OSPAR area,
- the volume of large spills on the DCS are quite modest compared to the OSPAR area as a whole,
- there is no clear trend in the quantities spilled on the DCS, within the reporting period and the same goes for the data for the OSPAR area as a whole.

## 6. Emissions to air

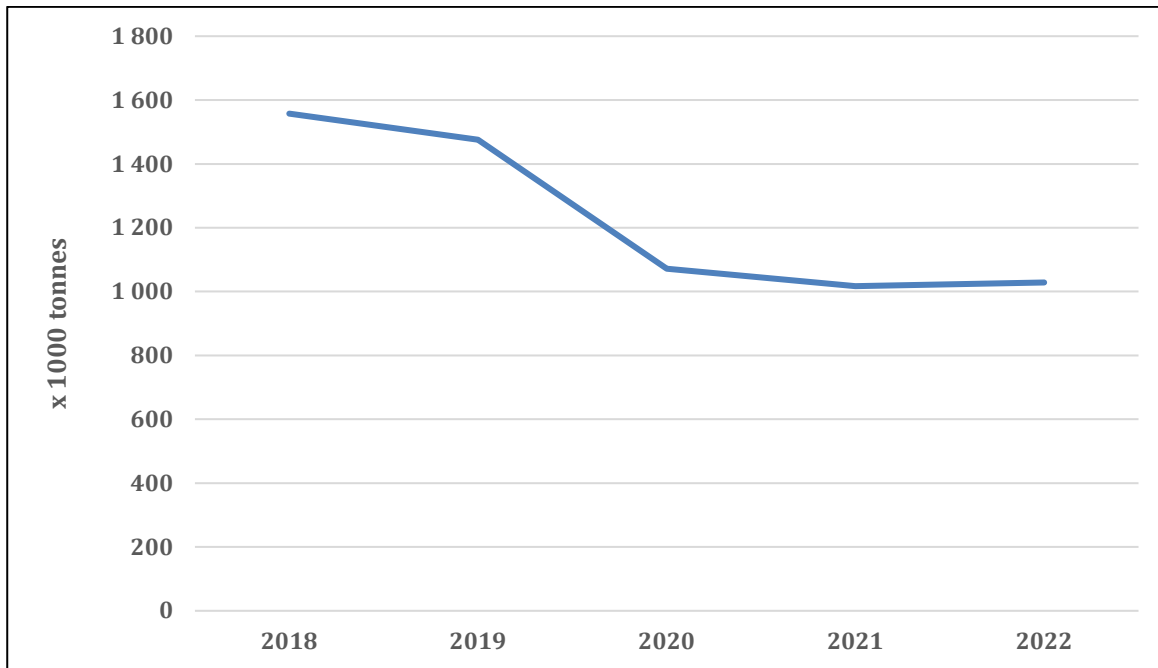
Atmospheric emissions are not covered by OSPAR measures or harmonised OSPAR measurement methodologies, but the reporting of these emissions is part of the annual reporting to OSPAR that is a requirement in the discharge permits issued by DEPA.

Of the atmospheric emissions reported to OSPAR, the emissions of nitrogen dioxide (NO<sub>x</sub>) from the offshore combustion plants (the LCPs) are regulated through approvals of the plants according to the Danish Act on Environmental Protection. Atmospheric emissions of carbon dioxide (CO<sub>2</sub>) are regulated through the Danish CO<sub>2</sub> allowance scheme<sup>6</sup>, as the emissions are reported annually to the Danish Energy Agency (DEA).

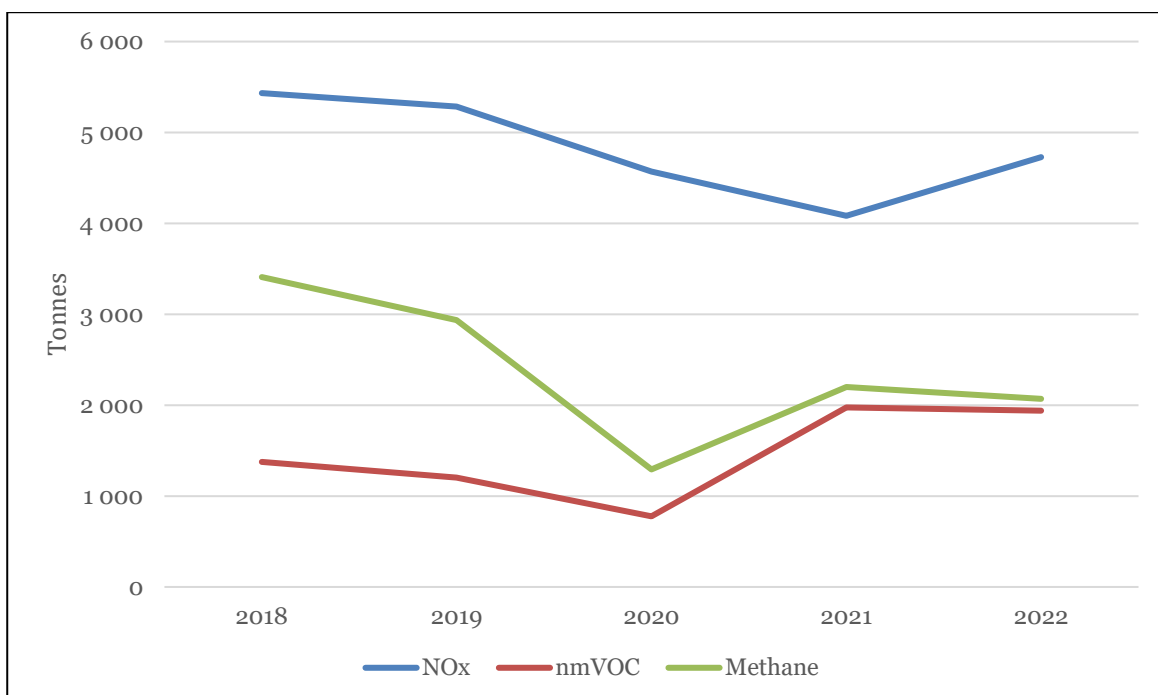
<sup>6</sup> According to Directive 2003/87/EC of the European Commission and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC.

For the atmospheric emissions of carbon dioxide CO<sub>2</sub> on the DCS, there has been a general downward trend between 2018 and 2022 (Figure 12). However, the downward trend can partly be attributed to the temporary close down and redevelopment of the Tyra field.

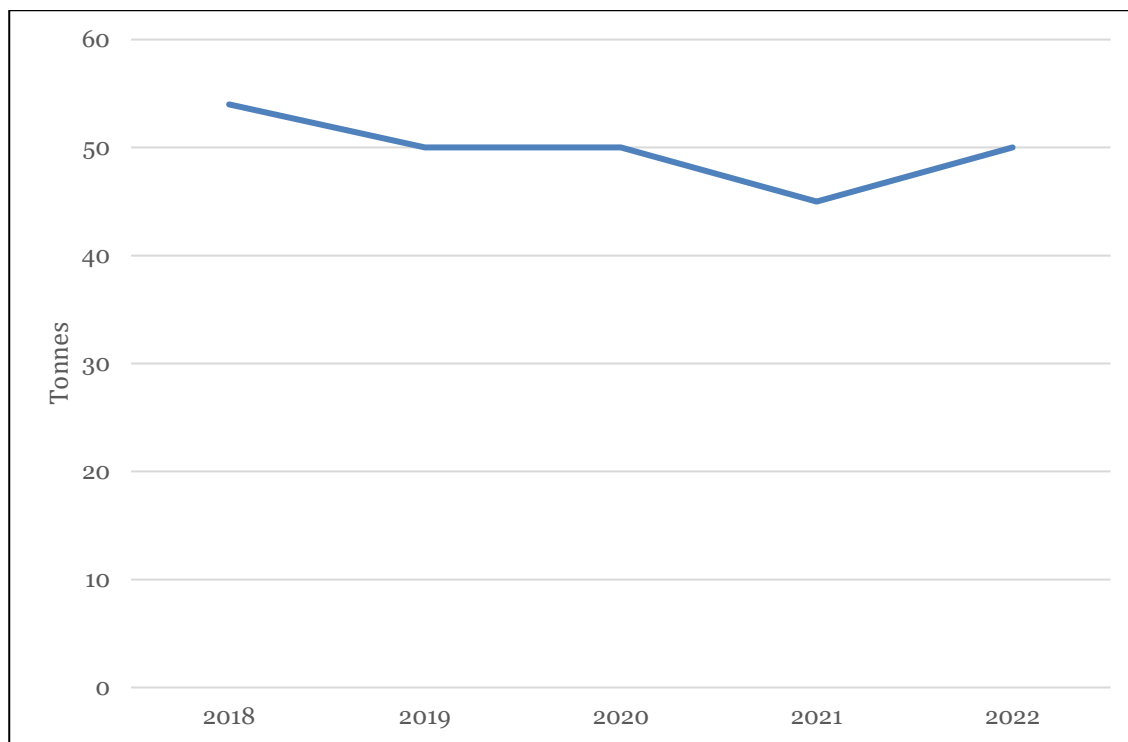
A similar downward trend was found for the emissions of Methane (Figure 13). For NO<sub>x</sub> and non-methane VOC the levels of emissions decrease from 2018 – 2020 and then rise again. The changes in emissions are mainly driven by the close down and redevelopment of the Tyra field and to some extent the level of well service activities.



**Figure 11: Emissions of carbon dioxide (CO<sub>2</sub>) on the Danish Continental Shelf 2018–2022**



**Figure 12: Emissions of nitrogen oxide (NO<sub>x</sub>), methane and nmVOC on the Danish Continental Shelf  
2018—2022**



**Figure 13: Emissions of sulphur dioxide (SO<sub>2</sub>) on the Danish Continental Shelf 2018—2022**

Emissions of sulphur dioxide follows the pattern of NO<sub>x</sub> and fluctuated with a low in 2021 but subsequently increased in 2022. There is no obvious trend in the pattern. The cause of the increased emission of sulphur dioxide in 2022 is likely attributed to an increase in well service activities.

## 7. QA procedures in Denmark

### 7.1. Counting of installations

In OSPAR, the number of installations is detailed in the "[Inventory of oil and gas offshore installations in the OSPAR maritime area](#)". The number of installations reported annually to OIC, as reflected in Table 2 of the present report, only comprises installations with discharges to the sea and emissions to air.

### 7.2. Reporting of dispersed oil

In Denmark operators are required to both quantify the amount of produced and displacement water discharged and to determine the concentration of dispersed oil in the discharge.

The concentration of dispersed oil is determined by sampling the discharge stream on a routine basis and analysing the samples in accordance with the requirements in the discharge permits based on OSPAR Recommendation 2001/1. Operators are required to sample discharge streams once per day and within the same 1-hour time interval each day. If more samples are taken (normally only relevant for discharges of produced water), the concentrations of dispersed oil in all the samples are to be reported in the monthly discharge reports to DEPA. Only the concentration value from the first sample are included in the calculation of the monthly weighted average concentration and again for the calculation of the total amount of oil discharged for that month. This procedure is valid during stable operational conditions, meaning that only few and smaller fluctuations in the oil concentration are registered through the online oil in water monitor.

If there is a risk of unstable operating conditions (see list below) or if bigger fluctuations in the oil concentration or concentrations of dispersed oil in the produced water above 100 mg/l are registered through the online monitor, the operator is required to initiate sampling of the produced water three times per day at an 8 hourly interval.

The increased sampling frequency shall be continued until three subsequent samples show a concentration of dispersed oil below 20 mg/l. A weighted daily average concentration of dispersed oil is calculated based on the three individual concentrations multiplied by the amount of produced water discharged from the time of the first sample and until the 2<sup>nd</sup> and 3<sup>rd</sup> samples respectively are taken.

The increased sampling frequency has to be started in advance of the initiation of activities that potentially can lead to unstable operating conditions. If this is not possible due to e.g. a shutdown of the discharge of produced water to the sea, the increased sampling frequency should be restarted when the discharge is resumed.

Unstable and potentially unstable operating conditions comprise:

- Pigging operations
- Planned well service operations and other maintenance operations that could influence the stability of the oil/water separation processes
- Well clean-up operations, including coiled tubing
- Tests of new offshore chemicals that could influence the stability of the oil/water separation processes
- Change of equipment
- Start up or shut down
- Other situations, where DEPA, according to requirements in the discharge permits, has been notified by the operator of upcoming activities, that could have a significant influence on the stability of the oil/water separation processes

The sampling frequency during both stable and unstable operating conditions is higher than the minimum required under OSPAR Recommendation 2001/1.

In addition the operators are required to report to DEPA if the concentration of dispersed oil has for 5 consecutive days been above 30 mg/l. The operator shall at the same time inform DEPA what action they have taken to ensure, that the monthly concentration average will not exceed the 30 mg/l limit value.

It is also a requirement in the discharge permits that online analysers for process monitoring are installed at all produced water discharge points to provide a real time indication of produced water quality so that any deterioration in quality can be responded to as quickly as possible. During DEPA's inspections print outs from the records made by the online monitors are examined and if relevant compared to the actions taken by the operator to reduce the oil concentration if the discharged water. The operators have so far evaluated that measurements done by the online monitors are not accurate and stable enough to be used for the monthly reporting of dispersed oil in the produced water.

While operators are required to report analysis results in accordance with the OSPAR Reference method all operators continue to undertake onsite analysis using infrared techniques and the results are then converted to an OSPAR Reference Method result using correlation graphs, which are updated every three months.

Sampling and analysis of produced water and displacement water have to be done according to national or international standards and in accordance with the principles of good laboratory practise (GLP). The standards will be specific for each type of sample and each analysis. In regards to the quantification of the discharges of produced water and displacement water the discharge permits does not comprise specific requirements for the maximum uncertainty on the flow measurements.

The operators are required to report both monthly and annually according to requirements in the discharge permits. The quality of data submitted is the responsibility of each operator. They are required to carry out a systematic review of their own data. The operators have to include details related to this in their management systems. DEPA may at any time request to see the documentation.

As mentioned above the permits include requirements, that the operators in the first half of each calendar year conduct and report to DEPA the results of an independent verification of both the oil in water sampling, analysing and reporting procedures. This also includes the procedures related to the measurements of the flow of produced water discharged to the sea or re-injected, including procedures for maintenance and calibration of flow meters. If the verification shows significant deviations from the prescribed procedures, the verification shall be repeated and reported to DEPA in the second half of the same year.

### **7.3. Reporting of chemical use and discharge**

Operators on the DCS are required to record the use and discharge of all offshore chemicals in accordance with the terms and conditions of the permit. Operators are required to report the use and discharge to DEPA on a yearly basis. The reporting covers both the production and drilling activities carried out by the operator. There are no specific requirements in the discharge permits on how the operators should quantify the use and discharge of offshore chemicals, so in principle it can vary from operator to operator and in relation to the activities, for which the chemicals are used and discharged. In some cases, the reporting is based on quantities shipped from suppliers, which may only provide a rough estimate over a certain period, but will average out over the year or longer periods. In other cases the operators record daily consumption from stock tanks on board the installation, which provides a more accurate and consistent measurement. There is no measurement uncertainty requirement.

The operators' chemical management systems and methods of reporting are reviewed during offshore inspections.

## **Appendix 1: OSPAR Measures associated with Offshore Oil and Gas industry**

### **Discharges contaminated with oil**

- PARCOM Recommendation 86/1 of a 40 mg/l Emission Standard for Platforms<sup>7</sup>;

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<sup>7</sup> PARCOM Recommendation of a 40 mg/l Emission Standard for Platforms, 1986 was revoked for produced water only by OSPAR Recommendation 2001/1 for the Management of Produced Water from Offshore Installations. However, this measure is still applicable in relation to ballast water, drainage water and displacement water from offshore installations.

- OSPAR Reference Method of Analysis for the Determination of the Dispersed Oil Content in Produced Water (OSPAR Agreement number: 2005—15);
- OSPAR Recommendation 2001/1 for the Management of Produced Water from Offshore Installations (as amended);
- OSPAR Recommendation 2012/5 for a risk-based approach to the Management of Produced Water Discharges from Offshore Installations

#### **Use and discharge of drilling fluids and cuttings**

- OSPAR Decision 2000/3 on the Use of Organic-phase Drilling Fluids (OPF) and the Discharge of OPF-contaminated Cuttings;
- Guidelines for the Consideration of the Best Environmental Option for the Management of OPF-Contaminated Cuttings Residue (OSPAR Agreement number: 2002—8);

#### **Chemicals used and discharged offshore**

- OSPAR Decision 2000/2 on a Harmonised Mandatory Control System for the Use and Reduction of the Discharge of Offshore Chemicals (as amended)
- OSPAR Recommendation 2017/01 on a Harmonised Pre-Screening Scheme for Offshore Chemicals;
- OSPAR Recommendation 2010/3 on a Harmonised Offshore Chemical Notification Format (HOCNF) (as amended);
- OSPAR Recommendation 2006/3 on Environmental Goals for the Discharge by the Offshore Industry of Chemicals that Are, or Which Contain Substances Identified as Candidates for Substitution;
- OSPAR Recommendation 2005/2 on Environmental Goals for the Discharge by the Offshore Industry of Chemicals that Are, or Contain Added Substances, Listed in the OSPAR 2004 List of Chemicals for Priority Action.

## Appendix 2 - Data

**Table 1: Number of installations on the DCS with discharges to the sea, or emissions to the air 2018—2022**

2018	2019	2020	2021	2022
21	21	10	11	11

**Table 2: Oily aqueous discharges to the maritime area**

**Table 2a: Oil discharged in displacement and produced water (in tonnes), 2018—2022**

2018 (GC-FID)	2019 (GC-FID)	2020 (GC-FID)	2021 (GC-FID)	2022 (GC-FID)
Dispersed	Dispersed	Dispersed	Dispersed	Dispersed
136,5	127	95,5	97,2	123,9

**Table 2b: Dissolved oil discharged in displacement and produced water (in tonnes), 2018—2022**

2018	2019	2020	2021	2022
BTEX	BTEX	BTEX	BTEX	BTEX
325	118	76	74,1	76,2

**Table 2c: Total volume of produced water and displacement water discharged, and produced water injected (in m<sup>3</sup>/year), 2018—2022**

	2018	2019	2020	2021	2022	2022 in %
Produced water discharged*	22 196 600	19 953 949	16 670 995	17 394 575	18 143 975	57,9
Produced water re-injected**	10 976 058	11 938 131	13 187 533	12 155 060	12 696 127	40,5
Displacement water discharged***	901 055	830 181	671 609	571 050	496 424	1,6
Total	34 073 713	32 722 261	30 530 137	30 120 685	31 336 526	100

\* Produced water

\*\* Injected produced and displacement water

\*\*\* Displacement water

**Table 3: Installations, which do not meet OSPAR performance standard for dispersed oil in aqueous discharges**

**Table 3b: Number of installations with discharges failing to meet the 30 mg oil/l performance standard, valid from 2018-2022, and quantity of oil discharged by these installations (in tonnes)**

	2018	2019	2020	2021	2022
Number of installations exceeding 30 mg/l	1	0	0	0	0
Quantity of dispersed oil discharged	0,034	0	0	0	0

**Table 4: Use and discharges of organic-phase drilling fluids (OPF) and cuttings**

**Table 4a: Quantities of oil and other organic-phase fluids discharged via cuttings (in tonnes), 2018 - 2022**

2018	2019	2020	2021	2022
Total OPF	Total OPF	Total OPF	Total OPF	Total OPF
0	0	0	0	0

**Table 4b: Number of wells drilled with OPF, with discharge of contaminated cuttings to the maritime area, 2018 - 2022**

2018		2019		2020		2021		2022	
OBF	non-OBF OPF	OBF	non-OBF OPF	OBF	Other OPF	OBF	Other OPF	OBF	Other OPF
0	0	0	0	0	0	0	0	0	0

**Table 5: Spillage of oil and chemicals**

**Table 5a: Number of oil spills, 2018—2022 - Spills less than 1 tonne and spills above 1 tonne**

2018		2019		2020		2021		2022	
≤ 1 t	> 1 t	≤ 1 t	> 1 t	≤ 1 t	> 1 t	≤ 1 t	> 1 t	≤ 1 t	> 1 t
30	2	12	0	14	0	11	0	8	0

**Table 5b: Total quantity of oil spilled, in tonnes, 2018—2022**

2018		2019		2020		2021		2022	
≤ 1 t	> 1 t	≤ 1 t	> 1 t	≤ 1 t	> 1 t	≤ 1 t	> 1 t	≤ 1 t	> 1 t
2,4	20,4	0,9	0	0,2	0	0,9	0	0,7	0

**Table 5c: Number of chemical spills, 2018—2022 - Spills less or equal to 1 ton and spills above 1 ton**

2018		2019		2020		2021		2022	
≤ 1 t	> 1 t	≤ 1 t	> 1 t	≤ 1 t	> 1 t	≤ 1 t	> 1 t	≤ 1 t	> 1 t
26	1	17	2	11	0	31	0	31	2

**Table 5d: Total quantity of chemicals spilled, in tonnes, 2018—2022**

2018		2019		2020		2021		2022	
≤ 1 t	> 1 t	≤ 1 t	> 1 t	≤ 1 t	> 1 t	≤ 1 t	> 1 t	≤ 1 t	> 1 t
1,4	1	2,5	6,7	0,7	0	2,7	0	0,7	8,3

**Table 6: Emissions to air, 2018—2022**

**CO<sub>2</sub> (in millions of tonnes)**

2018	2019	2020	2021	2022
1,5	1,4	1,0	1,0	1,0

**NO<sub>x</sub> (in thousands of tonnes)**

2018	2019	2020	2021	2022
5,4	5,2	4,5	4,0	4,7

**nmVOCs (in thousands of tonnes)**

2018	2019	2020	2021	2022
1,3	1,2	0,7	1,9	1,9

**CH<sub>4</sub> (in thousands of tonnes)**

2018	2019	2020	2021	2022
3,4	2,9	1,2	2,2	2,0

**SO<sub>2</sub> (in tonnes)**

2018	2019	2020	2021	2022
54	50	50	45	50

**Table 7: The use and discharge of offshore chemicals, 2018—2022**

**Table 7a: Quantity of offshore chemicals used in kg/year**

	2018	2019	2020	2021	2022
PLONOR <sup>B</sup>	15 120 362	17 497 988	2 767 535	2 426 921	2 232 913
List of Chemicals for Priority Action	0	5	0	0	0
Substances for substitution*			41 072	78 328	137 311
Inorganic LC <sub>50</sub> or EC <sub>50</sub> < 1 mg/l	55 138	42 611			
Biodegradation < 20%	34 760	23 950			
Substance meets two of three criteria	90	0			
Inorganic, LC <sub>50</sub> or EC <sub>50</sub> > 1 mg/l	586 398	1 792 186			
Ranking	7 659 426	7 923 989	7 161 899	7 163 454	10 162 133
<b>Total</b>	<b>23 456 174</b>	<b>27 302 328</b>	<b>9 970 495</b>	<b>9 668 703</b>	<b>12 532 358</b>

\*) Reporting format revised for year 2020 and onwards

**Table 7b: Quantity of offshore chemicals discharged in kg/year**

	2018	2019	2020	2021	2022
PLONOR <sup>B</sup>	6 559 931	7 041 000	1 111 772	796 946	813 054
List of Chemicals for Priority Action	0	0,45	0	0	0
Substances for substitution *			24 809	29 750	34 506
Inorganic LC <sub>50</sub> or EC <sub>50</sub> < 1 mg/l	40 446	28 590			
Biodegradation < 20%	0	0			
Substance meets two of three criteria	0	0			
Inorganic, LC <sub>50</sub> or EC <sub>50</sub> > 1 mg/l	41 577	128 547			
Ranking	3 634 209	3 767 895	3 282 736	3 649 573	4 326 637
<b>Total</b>	<b>10 276 163</b>	<b>10 967 326</b>	<b>4 419 317</b>	<b>4 476 269</b>	<b>5 174 198</b>

**Table 7c: Chemicals spilled in kg per year**

Pre-screening category	2018	2019	2020	2021	2022
PLONOR <sup>B</sup>	87	0	-	5	3 878
List of Chemicals for Priority Action	0	0	-	0	0
Substances for substitution			-	0,4	0
Inorganic LC <sub>50</sub> or EC <sub>50</sub> < 1 mg/l	0	59			
Biodegradation < 20%	0	0			
Substance meets two of three criteria	0	0			
Inorganic, LC <sub>50</sub> or EC <sub>50</sub> > 1 mg/l	1 666	136			
Ranking	0	500	-	61	2 121
<b>Total</b>	<b>1 753</b>	<b>695</b>	<b>730</b>	<b>66</b>	<b>5 999</b>

**Table 8: Denmark total production in oil equivalents (toeq)**

2018	2019	2020	2021	2022
9 075 918	7 857 922	4 875 981	4 507 199	4 416 749



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